

5.5.13. DS-0/DS-1 Terminal Factor

Definition: The relative terminal investment per DS-0, between the DS-1 and DS-0 levels.

Default Value:

DS-0 / DS-1 Terminal Factor
124

Support: The computed ratio for investment per DS-0 when provided in a DS-0 level signal, to per DS-0 investment when provided in a DS-1 level signal, based on transmission terminal investments (see 4.4.1 for terminal investments).

5.5.14. DS-1/DS-3 Terminal Factor

Definition: The relative investment per DS-0, between the DS-3 and DS-1 levels.

Default Value:

DS-1 / DS-3 Terminal Factor
9.9

Support: The computed ratio for investment per DS-0 when provided in a DS-1 level signal, to per DS-0 investment when provided in a DS-3 level signal, based on transmission terminal investments (i.e., 4.4.1).

5.5.15. Average Lines per Business Location

Definition: The average number of business lines per business location, used to calculate NID and drop cost. This parameter should be set the same as 2.2.5.

Default Value:

Average Business Lines per Location
4

Support: {NOTE: The discussion in Section 2.2.5. [Distribution] is reproduced here for ease of use.}

The number of lines per business location estimated by HAI is based on data in the 1995 Common Carrier Statistics and the 1995 Statistical Abstract of the United States.

5.5.16. Average Trunk Utilization

Definition: The 24 hour average utilization of an interoffice trunk.

Default Value:

Average Trunk Utilization
0.30

Support: AT&T Capacity Cost Study.⁵³

⁵³ Blake, et al., *"A Study of AT&T's Competitors' Capacity to Absorb Rapid Demand Growth"*, p.4.

6. EXCAVATION AND RESTORATION

6.1. UNDERGROUND EXCAVATION

Definition: The cost per foot to dig a trench in connection with building an underground conduit system to facilitate the placement of underground cables. Cutting the surface, placing the 4" PVC conduit pipes, backfilling the trench with appropriately screened fill, and restoring surface conditions is covered in the following section titled, "Underground Restoration Cost per Foot". These two sections do not include the material cost of the PVC conduit pipe, which is covered under "Conduit Material Investment per foot", and is affected by the number of cables placed in a conduit run, and the number of "Spare tubes per Route."

Default Values:

Underground Excavation Costs per Foot						
Density Range	Normal Trenching		Backhoe		Hand Trench	
	Fraction	Per Foot	Fraction	Per Foot	Fraction	Per Foot
0-5	54%	\$1.90	45%	\$3.00	1%	\$5.00
5-100	54%	\$1.90	45%	\$3.00	1%	\$5.00
100-200	54%	\$1.90	45%	\$3.00	1%	\$5.00
200-650	52%	\$1.90	45%	\$3.00	3%	\$5.00
650-850	52%	\$1.95	45%	\$3.00	3%	\$5.00
850-2,550	50%	\$2.15	45%	\$3.00	5%	\$5.00
2,550-5,000	35%	\$2.15	55%	\$3.00	10%	\$5.00
5,000-10,000	23%	\$6.00	67%	\$20.00	10%	\$10.00
10,000+	16%	\$6.00	72%	\$30.00	12%	\$18.00

Note: Fraction % for Normal Trenching is the fraction remaining after subtracting Backhoe % & Trench %.

Support: See discussion in Section 6.2.

6.2. UNDERGROUND RESTORATION

Definition: The cost per foot to cut the surface, place the 4" PVC conduit pipes, backfill the trench with appropriately screened fill, and restore surface conditions. Digging a trench in connection with building an underground conduit system to facilitate the placement of underground cables is covered in the preceding section titled, "Underground Excavation Cost per Foot". These two sections do not include the material cost of the PVC conduit pipe, which is covered under "Conduit Material Investment per foot", and is affected by the number of cables placed in a conduit run, and the number of "Spare tubes per Route."

Default Values:

Underground Restoration Costs per Foot												
	Cut/Restore Asphalt		Cut/Restore Concrete		Cut/Restore Sod		Simple Backfill		Conduit Placement & Stabilization			
Density Range	Fraction	Per Foot	Fraction	Per Foot	Fraction	Per Foot	Fraction	Per Foot	Fraction	Pave-ment/Ft	Fraction	Dirt/Ft
0-5	55%	\$6.00	10%	\$9.00	1%	\$1.00	34%	\$0.15	65%	\$5.00	35%	\$1.00
5-100	55%	\$6.00	10%	\$9.00	1%	\$1.00	34%	\$0.15	65%	\$5.00	35%	\$1.00
100-200	55%	\$6.00	10%	\$9.00	1%	\$1.00	34%	\$0.15	65%	\$5.00	35%	\$1.00
200-650	65%	\$6.00	10%	\$9.00	3%	\$1.00	22%	\$0.15	75%	\$5.00	25%	\$1.00
650-850	70%	\$6.00	10%	\$9.00	4%	\$1.00	16%	\$0.15	80%	\$5.00	20%	\$1.00
850-2,550	75%	\$6.00	10%	\$9.00	6%	\$1.00	9%	\$0.15	85%	\$9.00	15%	\$4.00
2,550-5,000	75%	\$6.00	15%	\$9.00	4%	\$1.00	6%	\$0.15	90%	\$13.00	10%	\$11.00
5,000-10,000	80%	\$18.00	15%	\$21.00	2%	\$1.00	3%	\$0.15	95%	\$17.00	5%	\$12.00
10,000+	82%	\$30.00	16%	\$36.00	0%	\$1.00	2%	\$0.15	98%	\$20.00	2%	\$16.00

Note: Fraction % for Simple Backfill is the fraction remaining after subtracting Asphalt % & Concrete % & Sod %.

Fraction % for Conduit Placement & Stabilization for Pavement is Asphalt % + Concrete %.

Fraction % for Conduit Placement & Stabilization for Dirt is Sod % + Simple Backfill %.

Support: The costs reflect a mixture of different types of placement activities.

Note: Use of underground conduit structure for distribution should be infrequent, especially in the lower density zones. Although use of conduit for distribution cable in lower density zones is not expected, default prices are shown, should a user elect to change parameters for percent underground, aerial, and buried structure allowed by the HM 5.0a model structure.

Excavation and restoral costs are significantly higher in the two highest density zones to care for working within congested subsurface facility conditions, handling traffic control, work hour restrictions, concrete encasement of ducts, and atypical trench depths.

A compound weighted cost for conduit excavation, placement and restoral can be calculated by multiplying the individual columns shown above and in the immediately preceding section, "Underground Excavation Costs per Foot". Performing such calculations using the default values shown would provide the following composite costs by density zone.

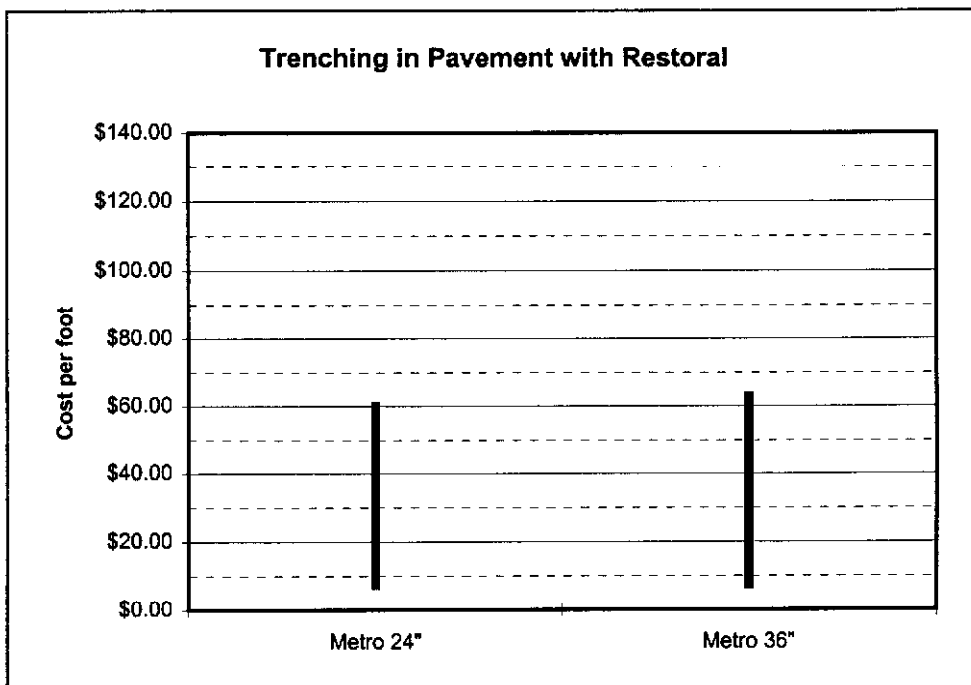
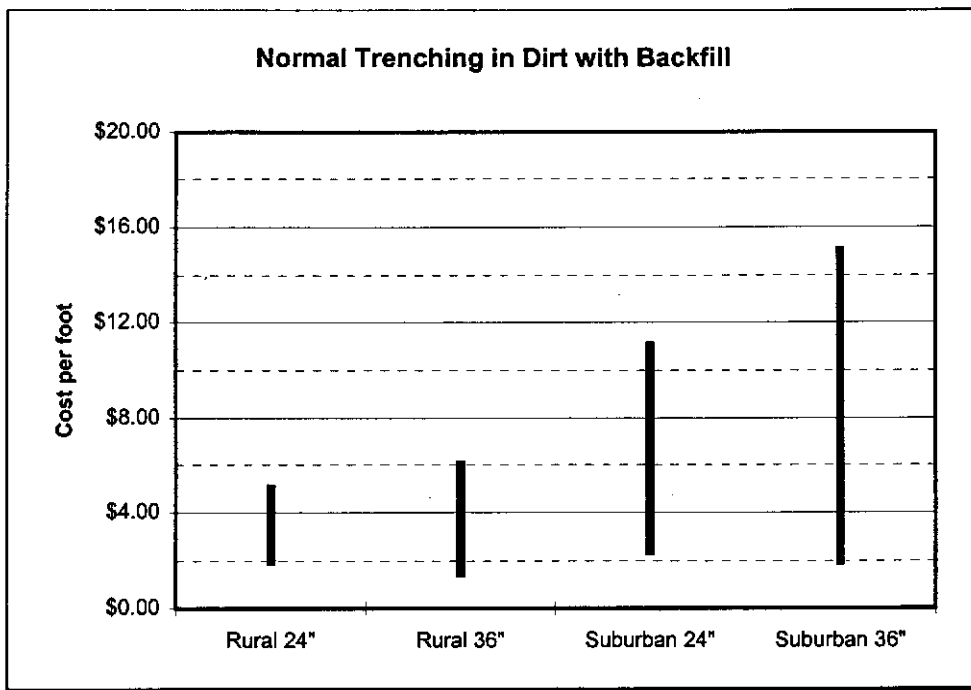
The percentages for Underground Excavation Costs total to 100%, for Restoration (Asphalt + Concrete + Sod + Simple Backfill) total to 100%, and for Conduit Placement & Stabilization total to 100%, since each is a discrete function.

Underground Excavation, Restoration, and Conduit Placement Cost per Foot	
Density Zone	Cost Per Foot
0-5	\$10.29
5-100	\$10.29
100-200	\$10.29
200-650	\$11.35
650-850	\$11.88
850-2,550	\$16.40
2,550-5,000	\$21.60
5,000-10,000	\$50.10
10,000+	\$75.00

Costs for various trenching methods were estimated by a team of experienced outside plant experts. Additional information was obtained from printed resources⁵⁴. Still other information was provided by several contractors who routinely perform excavation, conduit, and manhole placement work for telephone companies. Results of those inquiries are revealed in the following charts. Note that this survey demonstrates that costs do not vary significantly between buried placements at 24" underground versus 36" underground. Therefore the HAI Model assumes an average placement depth ranging from 24" to 36", averaging 30".

Conduit placement cost is essentially the same, whether the conduit is used to house distribution cable, feeder cable, interoffice cable, or other telecommunication carrier cable, including CATV.

⁵⁴ Martin D. Kiley and Marques Allyn, eds., *1997 National Construction Estimator 45th Edition*, pp. 12-15.



6.3. BURIED EXCAVATION

Definition: The cost per foot to dig a trench to allow buried placement of cables, or the plowing of one or more cables into the earth using a single or multiple sheath plow.

Default Values:

Buried Excavation Costs per Foot												
	Plow		Normal Trench		Backhoe		Hand Trench		Bore Cable		Push Pipe / Pull Cable	
Density Range	Frac-tion	Per Foot	Frac-tion	Per Foot	Frac-tion	Per Foot	Frac-tion	Per Foot	Frac-tion	Per Foot	Frac-tion	Per Foot
0-5	60%	\$0.80	28%	\$1.90	10%	\$3.00	0%	\$5.00	0%	\$11.00	2%	\$6.00
5-100	60%	\$0.80	28%	\$1.90	10%	\$3.00	0%	\$5.00	0%	\$11.00	2%	\$6.00
100-200	60%	\$0.80	28%	\$1.90	10%	\$3.00	0%	\$5.00	0%	\$11.00	2%	\$6.00
200-650	50%	\$0.80	37%	\$1.90	10%	\$3.00	1%	\$5.00	0%	\$11.00	2%	\$6.00
650-850	35%	\$0.80	51%	\$1.95	10%	\$3.00	2%	\$5.00	0%	\$11.00	2%	\$6.00
850-2,550	20%	\$1.20	59%	\$2.15	10%	\$3.00	4%	\$5.00	3%	\$11.00	4%	\$6.00
2,550-5,000	0%	\$1.20	76%	\$2.15	10%	\$3.00	5%	\$5.00	4%	\$11.00	5%	\$6.00
5,000-10,000	0%	\$1.20	73%	\$6.00	10%	\$20.00	6%	\$10.00	5%	\$11.00	6%	\$6.00
10,000+	0%	\$1.20	54%	\$15.00	25%	\$30.00	10%	\$18.00	5%	\$18.00	6%	\$24.00

Note: Fraction % for Normal Trenching is the fraction remaining after subtracting Plow %, Backhoe %, Hand Trench %, Bore Cable % and Push Pipe / Pull Cable % from 100%.

Support: See discussion in Section 6.4.

6.4. BURIED INSTALLATION AND RESTORATION

Definition: The cost per foot to push pipe under pavement, or the costs per foot to cut the surface, place cable in a trench, backfill the trench with appropriately screened fill, and restore surface conditions. Digging a trench in connection with placing buried cable is covered in the preceding section titled, "Buried Excavation Cost per Foot".

Default Values:

Buried Installation and Restoration Costs per Foot									
Density Range	Cut/Restore Asphalt		Cut/Restore Concrete		Cut/Restore Sod		Simple Backfill		Restoral Not Req'd
	Frac-tion	Per Foot	Frac-tion	Per Foot	Frac-tion	Per Foot	Frac-tion	Per Foot	Fraction
0-5	3%	\$6.00	1%	\$9.00	2%	\$1.00	32%	\$0.15	62%
5-100	3%	\$6.00	1%	\$9.00	2%	\$1.00	32%	\$0.15	62%
100-200	3%	\$6.00	1%	\$9.00	2%	\$1.00	32%	\$0.15	62%
200-650	3%	\$6.00	1%	\$9.00	2%	\$1.00	42%	\$0.15	52%
650-850	3%	\$6.00	1%	\$9.00	2%	\$1.00	57%	\$0.15	37%
850-2,550	5%	\$6.00	3%	\$9.00	35%	\$1.00	30%	\$0.15	27%
2,550-5,000	8%	\$6.00	5%	\$9.00	35%	\$1.00	43%	\$0.15	9%
5,000-10,000	18%	\$18.00	8%	\$21.00	11%	\$1.00	52%	\$0.15	11%
10,000+	60%	\$30.00	20%	\$36.00	5%	\$1.00	4%	\$0.15	11%

Note: Note: Restoral is not required for plowing, boring, or pushing pipe & pulling cable. Fraction for Simple Backfill is the fraction remaining after subtracting the Restoral Not Required fraction and the cut/restore activities fractions from 100%.

Support:

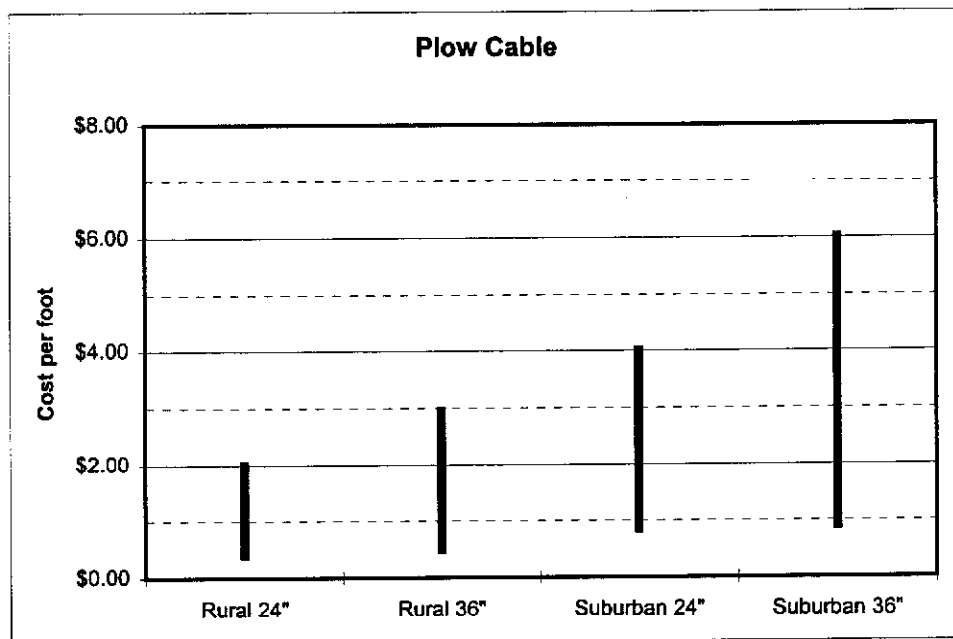
The costs reflect a mixture of different types of placement activities.

Excavation and restoral costs are significantly higher in the two highest density zones to care for working within congested subsurface facility conditions, handling traffic control, work hour restrictions, and atypical trench depths.

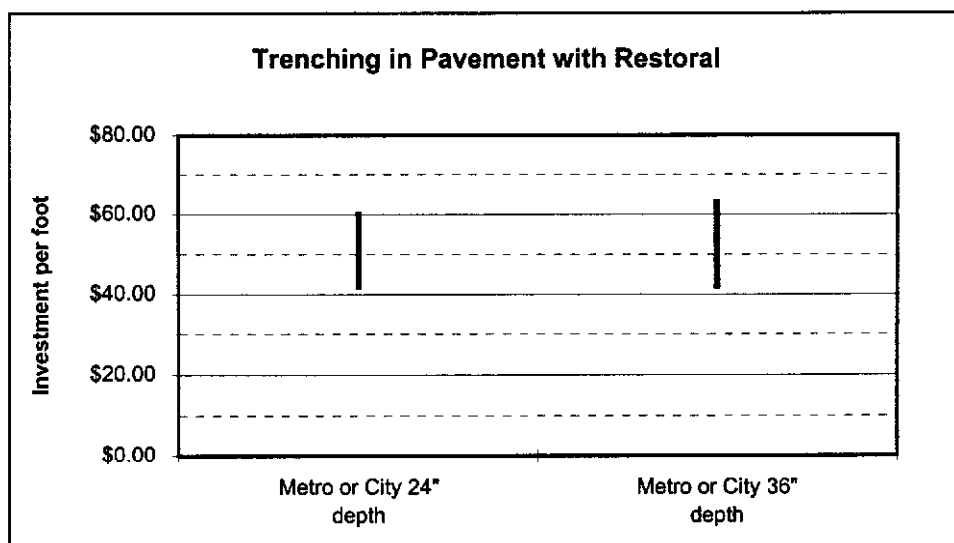
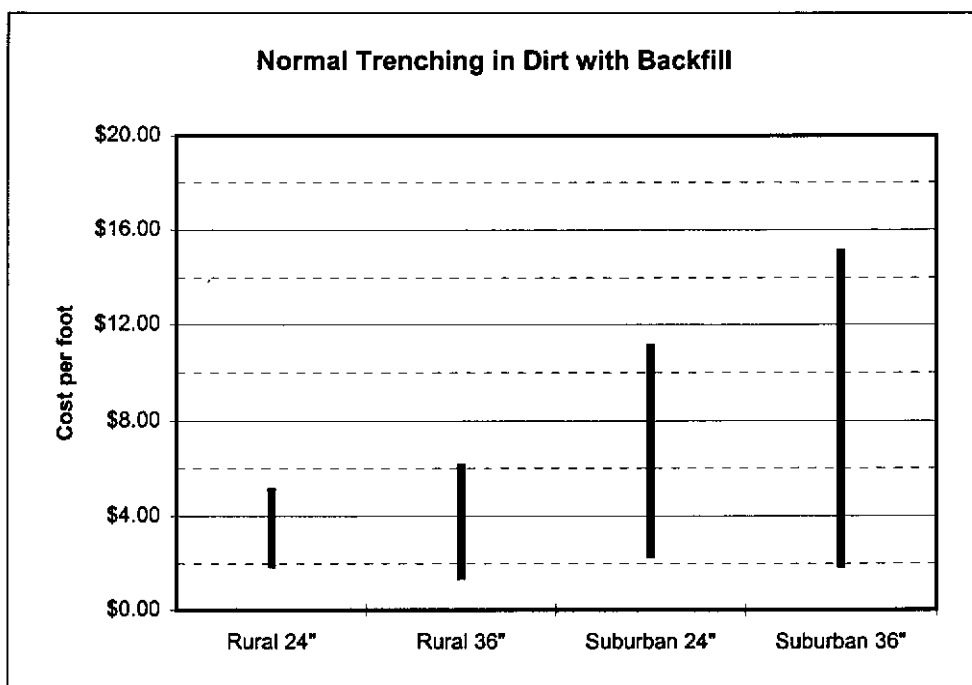
A compound weighted cost for conduit excavation, placement and restoral can be calculated by multiplying the individual columns shown above and in the immediately preceding section, "Buried Excavation Costs per Foot". Performing such calculations using the default values shown would provide the following composite costs by density zone.

Buried Excavation, Installation, and Restoration Cost per Foot	
Density Zone	Cost Per Foot
0-5	\$1.77
5-100	\$1.77
100-200	\$1.77
200-650	\$1.93
650-850	\$2.17
850-2,550	\$3.54
2,550-5,000	\$4.27
5,000-10,000	\$13.00
10,000+	\$45.00

Costs for various excavation methods were estimated by a team of experienced outside plant experts. Additional information was obtained from printed resources⁵⁵. Still other information was provided by several contractors who routinely perform excavation, conduit, and manhole placement work for telephone companies. Results of those inquiries are revealed in the following charts. Note that this survey demonstrates that costs do not vary significantly between buried placements at 24" underground versus 36" underground. Therefore the HAI Model assumes an average placement depth ranging from 24" to 36", averaging 30".



⁵⁵ Martin D. Kiley and Marques Allyn, eds., *1997 National Construction Estimator 45th Edition*, pp. 12-15.



6.5. SURFACE TEXTURE MULTIPLIER

Definition: The increase in placement cost attributable to the soil condition in a main cluster and its associated outlier clusters, expressed as a multiplier of a fraction of all buried or underground structure excavation components in the clusters. The multiplier appears in the "Effect" column, and the fraction appears in the "Fraction of Cluster Affected" column. The surface conditions are determined from the CBG to which the clusters belong. The table lists effects in alphabetical order by Texture Code.

Default Values:

Fraction Cluster Affected	Effect	Texture	Description of Texture
1.00	1.00		Blank
1.00	1.00	BY	Bouldery
1.00	1.00	BY-COS	Bouldery Coarse Sand
1.00	1.00	BY-FSL	Bouldery & Fine Sandy Loam
1.00	1.00	BY-L	Bouldery & Loam
1.00	1.00	BY-LS	Bouldery & Sandy Loam
1.00	1.00	BY-SICL	Bouldery & Silty Clay Loam
1.00	1.00	BY-SL	Bouldery & Sandy Loam
1.00	1.10	BYV	Very Bouldery
1.00	1.10	BYV-FSL	Very Bouldery & Fine Sandy Loam
1.00	1.10	BYV-L	Very Bouldery & Loamy
1.00	1.10	BYV-LS	Very Bouldery & Loamy Sand
1.00	1.10	BYV-SIL	Very Bouldery & Silt
1.00	1.10	BYV-SL	Very Bouldery & Sandy Loam
1.00	1.30	BYX	Extremely Bouldery
1.00	1.30	BYX-FSL	Extremely Bouldery & Fine Sandy Loam
1.00	1.30	BYX-L	Extremely Bouldery & Loamy
1.00	1.30	BYX-SIL	Extremely Bouldery & Silt Loam
1.00	1.30	BYX-SL	Extremely Bouldery & Sandy Loam
1.00	1.00	C	Clay
1.00	1.00	CB	Cobbly
1.00	1.00	CB-C	Cobbly & Clay
1.00	1.00	CB-CL	Cobbly & Clay Loam
1.00	1.00	CB-COSL	Cobbly & Coarse Sandy Loam
1.00	1.10	CB-FS	Cobbly & Fine Sand
1.00	1.10	CB-FSL	Cobbly & Fine Sandy Loam
1.00	1.00	CB-L	Cobbly & Loamy
1.00	1.00	CB-LCOS	Cobbly & Loamy Coarse Sand
1.00	1.00	CB-LS	Cobbly & Loamy Sand
1.00	1.10	CB-S	Cobbly & Sand
1.00	1.00	CB-SCL	Cobbly & Sandy Clay Loam
1.00	1.00	CB-SICL	Cobbly & Silty Clay Loam
1.00	1.00	CB-SIL	Cobbly & Silt Loam
1.00	1.10	CB-SL	Cobbly & Sandy Loam
1.00	1.00	CBA	Angular Cobbly

Fraction Cluster Affected	Effect	Texture	Description of Texture
1.00	1.10	CBA-FSL	Angular Cobbly & Fine Sandy Loam
1.00	1.20	CBV	Very Cobbly
1.00	1.20	CBV-C	Very Cobbly & Clay
1.00	1.20	CBV-CL	Very Cobbly & Clay Loam
1.00	1.20	CBV-FSL	Very Cobbly & Fine Sandy Loam
1.00	1.20	CBV-L	Very Cobbly & Loamy
1.00	1.20	CBV-LFS	Very Cobbly & Fine Loamy Sand
1.00	1.20	CBV-LS	Very Cobbly & Loamy Sand
1.00	1.20	CBV-MUCK	Very Cobbly & Muck
1.00	1.20	CBV-SCL	Very Cobbly & Sandy Clay Loam
1.00	1.20	CBV-SIL	Very Cobbly & Silt
1.00	1.20	CBV-SL	Very Cobbly & Sandy Loam
1.00	1.20	CBV-VFS	Very Cobbly & Very Fine Sand
1.00	1.20	CBX	Extremely Cobbly
1.00	1.20	CBX-CL	Extremely Cobbly & Clay
1.00	1.20	CBX-L	Extremely Cobbly Loam
1.00	1.20	CBX-SIL	Extremely Cobbly & Silt
1.00	1.20	CBX-SL	Extremely Cobbly & Sandy Loam
1.00	1.30	CBX-VFSL	Extremely Cobbly Very Fine Sandy Loam
1.00	1.00	CE	Coprogenous Earth
1.00	1.00	CIND	Cinders
1.00	1.00	CL	Clay Loam
1.00	1.30	CM	Cemented
1.00	1.00	CN	Channery
1.00	1.00	CN-CL	Channery & Clay Loam
1.00	1.10	CN-FSL	Channery & Fine Sandy Loam
1.00	1.00	CN-L	Channery & Loam
1.00	1.00	CN-SICL	Channery & Silty Clay Loam
1.00	1.00	CN-SIL	Channery & Silty Loam
1.00	1.00	CN-SL	Channery & Sandy Loam
1.00	1.00	CNV	Very Channery
1.00	1.00	CNV-CL	Very Channery & Clay
1.00	1.00	CNV-L	Very Channery & Loam
1.00	1.00	CNV-SCL	Channery & Sandy Clay Loam
1.00	1.00	CNV-SIL	Very Channery & Silty Loam
1.00	1.00	CNV-SL	Very Channery & Sandy Loam
1.00	1.00	CNX	Extremely Channery
1.00	1.00	CNX-SL	Extremely Channery & Sandy Loam
1.00	1.00	COS	Coarse Sand
1.00	1.00	COSL	Coarse Sandy Loam
1.00	1.20	CR	Cherty
1.00	1.20	CR-L	Cherty & Loam
1.00	1.20	CR-SICL	Cherty & Silty Clay Loam
1.00	1.20	CR-SIL	Cherty & Silty Loam
1.00	1.20	CR-SL	Cherty & Sandy Loam

Fraction Cluster Affected	Effect	Texture	Description of Texture
1.00	1.20	CRC	Coarse Cherty
1.00	1.20	CRV	Very Cherty
1.00	1.20	CRV-L	Very Cherty & Loam
1.00	1.20	CRV-SIL	Very Cherty & Silty Loam
1.00	1.30	CRX	Extremely Cherty
1.00	1.30	CRX-SIL	Extremely Cherty & Silty Loam
1.00	1.00	DE	Diatomaceous Earth
1.00	1.00	FB	Fibric Material
1.00	1.00	FINE	Fine
1.00	1.00	FL	Flaggy
1.00	1.10	FL-FSL	Flaggy & Fine Sandy Loam
1.00	1.00	FL-L	Flaggy & Loam
1.00	1.00	FL-SIC	Flaggy & Silty Clay
1.00	1.00	FL-SICL	Flaggy & Silty Clay Loam
1.00	1.00	FL-SIL	Flaggy & Silty Loam
1.00	1.00	FL-SL	Flaggy & Sandy Loam
1.00	1.10	FLV	Very Flaggy
1.00	1.10	FLV-COSL	Very Flaggy & Coarse Sandy Loam
1.00	1.10	FLV-L	Very Flaggy & Loam
1.00	1.10	FLV-SICL	Very Flaggy & Silty Clay Loam
1.00	1.10	FLV-SL	Very Flaggy & Sandy Loam
1.00	1.10	FLX	Extremely Flaggy
1.00	1.10	FLX-L	Extremely Flaggy & Loamy
1.00	1.00	FRAG	Fragmental Material
1.00	1.10	FS	Fine Sand
1.00	1.10	FSL	Fine Sandy Loam
1.00	1.00	G	Gravel
1.00	1.00	GR	Gravelly
1.00	1.00	GR-C	Gravel & Clay
1.00	1.00	GR-CL	Gravel & Clay Loam
1.00	1.00	GR-COS	Gravel & Coarse Sand
1.00	1.00	GR-COSL	Gravel & Coarse Sandy Loam
1.00	1.00	GR-FS	Gravel & Fine Sand
1.00	1.00	GR-FSL	Gravel & Fine Sandy Loam
1.00	1.00	GR-L	Gravel & Loam
1.00	1.00	GR-LCOS	Gravel & Loamy Coarse Sand
1.00	1.10	GR-LFS	Gravel & Loamy Fine Sand
1.00	1.00	GR-LS	Gravel & Loamy Sand
1.00	1.00	GR-MUCK	Gravel & Muck
1.00	1.00	GR-S	Gravel & Sand
1.00	1.00	GR-SCL	Gravel & Sandy Clay Loam
1.00	1.00	GR-SIC	Gravel & Silty Clay
1.00	1.00	GR-SICL	Gravel & Silty Clay Loam
1.00	1.00	GR-SIL	Gravel & Silty Loam
1.00	1.00	GR-SL	Gravel & Sandy Loam

Fraction Cluster Affected	Effect	Texture	Description of Texture
1.00	1.10	GR-VFSL	Gravel & Very Fine Sandy Loam
1.00	1.00	GRC	Coarse Gravelly
1.00	1.00	GRF	Fine Gravel
1.00	1.00	GRF-SIL	Fine Gravel Silty Loam
1.00	1.00	GRV	Very Gravelly
1.00	1.00	GRV-CL	Very gravelly & Clay loam
1.00	1.00	GRV-COS	Very Gravelly & coarse Sand
1.00	1.00	GRV-COSL	Very Gravelly & coarse Sandy Loam
1.00	1.00	GRV-FSL	Very Gravelly & Fine Sandy Loam
1.00	1.00	GRV-L	Very Gravelly & Loam
1.00	1.00	GRV-LCOS	Very Gravelly & Loamy Coarse Sand
1.00	1.00	GRV-LS	Very Gravelly & Loamy Sand
1.00	1.00	GRV-S	Very Gravelly & Sand
1.00	1.00	GRV-SCL	Very Gravelly & Sandy Clay Loam
1.00	1.00	GRV-SICL	Very Gravelly & Silty Clay Loam
1.00	1.00	GRV-SIL	Very Gravelly & Silt
1.00	1.00	GRV-SL	Very Gravelly & Sandy Loam
1.00	1.00	GRV-VFS	Very Gravelly & Very Fine Sand
1.00	1.00	GRV-VFSL	Very Gravelly & Very Fine Sandy Loam
1.00	1.10	GRX	Extremely Gravelly
1.00	1.10	GRX-CL	Extremely Gravelly & Coarse Loam
1.00	1.10	GRX-COS	Extremely Gravelly & Coarse Sand
1.00	1.10	GRX-COSL	Extremely Gravelly & Coarse Sandy Loam
1.00	1.10	GRX-FSL	Extremely Gravelly & Fine Sand Loam
1.00	1.10	GRX-L	Extremely Gravelly & Loam
1.00	1.10	GRX-LCOS	Extremely Gravelly & Loamy Coarse
1.00	1.10	GRX-LS	Extremely Gravelly & Loamy Sand
1.00	1.10	GRX-S	Extremely Gravelly & Sand
1.00	1.10	GRX-SIL	Extremely Gravelly & Silty Loam
1.00	1.10	GRX-SL	Extremely Gravelly & Sandy Loam
1.00	1.20	GYP	Gypsiferous Material
1.00	1.00	HM	Hemic Material
1.00	1.50	ICE	Ice or Frozen Soil
1.00	1.20	IND	Indurated
1.00	1.00	L	Loam
1.00	1.00	LCOS	Loamy Coarse Sand
1.00	1.10	LFS	Loamy Fine Sand
1.00	1.00	LS	Loamy Sand
1.00	1.00	LVFS	Loamy Very Fine Sand
1.00	1.00	MARL	Marl
1.00	1.00	MEDIUM coarse	Medium Coarse
1.00	1.00	MK	Mucky
1.00	1.00	MK-C	Mucky Clay
1.00	1.00	MK-CL	Mucky Clay Loam

Fraction Cluster Affected	Effect	Texture	Description of Texture
1.00	1.00	MK-FS	Muck & Fine Sand
1.00	1.00	MK-FSL	Muck & Fine Sandy Loam
1.00	1.00	MK-L	Mucky Loam
1.00	1.00	MK-LFS	Mucky Loamy Fine Sand
1.00	1.00	MK-LS	Mucky Loamy Sand
1.00	1.00	MK-S	Muck & Sand
1.00	1.00	MK-SI	Mucky & Silty
1.00	1.00	MK-SICL	Mucky & Silty Clay Loam
1.00	1.00	MK-SIL	Mucky Silt
1.00	1.00	MK-SL	Mucky & Sandy Loam
1.00	1.00	MK-VFSL	Mucky & Very Fine Sandy Loam
1.00	1.00	MPT	Mucky Peat
1.00	1.00	MUCK	Muck
1.00	1.00	PEAT	Peat
1.00	1.00	PT	Peaty
1.00	1.50	RB	Rubbly
1.00	1.50	RB-FSL	Rubbly Fine Sandy Loam
1.00	1.00	S	Sand
1.00	1.00	SC	Sandy Clay
1.00	1.00	SCL	Sandy Clay Loam
1.00	1.00	SG	Sand & Gravel
1.00	1.00	SH	Shaly
1.00	1.00	SH-CL	Shaly & Clay
1.00	1.00	SH-L	Shale & Loam
1.00	1.00	SH-SICL	Shaly & Silty Clay Loam
1.00	1.00	SH-SIL	Shaly & Silt Loam
1.00	1.50	SHV	Very Shaly
1.00	1.50	SHV-CL	Very Shaly & Clay Loam
1.00	2.00	SHX	Extremely Shaly
1.00	1.00	SI	Silt
1.00	1.00	SIC	Silty Clay
1.00	1.00	SICL	Silty Clay Loam
1.00	1.00	SIL	Silt Loam
1.00	1.00	SL	Sandy Loam
1.00	1.00	SP	Sapric Material
1.00	1.00	SR	Stratified
1.00	1.00	ST	Stony
1.00	1.00	ST-C	Stony & Clay
1.00	1.00	ST-CL	Stony & Clay Loam
1.00	1.00	ST-COSL	Stony & Coarse Sandy Loam
1.00	1.10	ST-FSL	Stony & Fine Sandy Loam
1.00	1.00	ST-L	Stony & Loamy
1.00	1.00	ST-LCOS	Stony & Loamy Coarse Sand
1.00	1.10	ST-LFS	Stony & Loamy Fine Sand
1.00	1.00	ST-LS	Stony & Loamy Sand

Fraction Cluster Affected	Effect	Texture	Description of Texture
1.00	1.00	ST-SIC	Stony & Silty Clay
1.00	1.00	ST-SICL	Stony & Silty Clay Loam
1.00	1.00	ST-SIL	Stony & Silt Loam
1.00	1.00	ST-SL	Stony & Sandy Loam
1.00	1.10	ST-VFSL	Stony & Sandy Very Fine Silty Loam
1.00	1.20	STV	Very Stony
1.00	1.20	STV-C	Very Stony & Clay
1.00	1.20	STV-CL	Very Stony & Clay Loam
1.00	1.20	STV-FSL	Very Stony & Fine Sandy Loam
1.00	1.20	STV-L	Very Stony & Loamy
1.00	1.20	STV-LFS	Very Stony & Loamy Fine Sand
1.00	1.20	STV-LS	Very Stony & Loamy Sand
1.00	1.20	STV-MPT	Very Stony & Mucky Peat
1.00	1.20	STV-MUCK	Very Stony & Muck
1.00	1.20	STV-SICL	Very Stony & Silty Clay Loam
1.00	1.20	STV-SIL	Very Stony & Silty Loam
1.00	1.20	STV-SL	Very Stony & Sandy Loam
1.00	1.20	STV-VFSL	Very Stony & Very Fine Sandy Loam
1.00	1.30	STX	Extremely Stony
1.00	1.30	STX-C	Extremely Stony & Clay
1.00	1.30	STX-CL	Extremely Stony & Clay Loam
1.00	1.30	STX-COS	Extremely Stony & Coarse Sand
1.00	1.30	STX-COSL	Extremely Stony & Coarse Sand Loam
1.00	1.30	STX-FSL	Extremely Stony & Fine Sandy Loam
1.00	1.30	STX-L	Extremely Stony & Loamy
1.00	1.30	STX-LCOS	Extremely Stony & Loamy Coarse Sand
1.00	1.30	STX-LS	Extremely Stony & Loamy Sand
1.00	1.30	STX-MUCK	Extremely Stony & Muck
1.00	1.30	STX-SIC	Extremely Stony & Silty Clay
1.00	1.30	STX-SICL	Extremely Stony & Silty Clay Loam
1.00	1.30	STX-SIL	Extremely Stony & Silty Loam
1.00	1.30	STX-SL	Extremely Stony & Sandy Loam
1.00	1.30	STX-VFSL	Extremely Stony & Very Fine Sandy Loam
1.00	3.00	SY	Slaty
1.00	3.00	SY-L	Slaty & Loam
1.00	3.00	SY-SIL	Slaty & Silty Loam
1.00	3.50	SYV	Very Slaty
1.00	4.00	SYX	Extremely Slaty
1.00	1.00	UNK	Unknown
1.00	2.00	UWB	Unweathered Bedrock
1.00	1.00	VAR	Variable
1.00	1.00	VFS	Very Fine Sand
1.00	1.00	VFSL	Very Fine Sandy loam
1.00	3.00	WB	Weathered Bedrock

Support: Discussions with excavation contractors who routinely perform work in a variety of soil conditions are reflected in the default difficulty factors listed above. Difficulty factors range from 1.00, or no additional effect, to as high as 4.0, or 400% as much as normal.

Although an engineer would normally modify plans to avoid difficult soil textures where possible, and although it is likely that population is located in portions of a CBG where conditions are less severe than is the average throughout the CBG, HM 5.0a has taken the conservative approach of assuming that the difficult terrain factors would affect 100% of the cluster.

7. REGIONAL LABOR ADJUSTMENT FACTORS

Definition: Factors that adjust a specific portion of certain investments by a labor factor adjustment that account for regional differences in the availability of trained labor, union contracts, and cost of living factors. Both the portions of different categories of investments that are affected and the size of adjustment are included as parameters.

Default Value:

Regional Labor Adjustment Factor	
Factor	1.0

Regional Labor Adjustment Factor Fraction of Installed Investment Affected	
Contractor Trenching	.125
Telco Construction - Copper	.164
Telco Construction - Fiber	.364
Telco I&M - NID & Drop	.571
Pole Placing	.518

Support: Different areas of the country are known to experience variations in wages paid to technicians, depending on availability of trained labor, union contracts, and cost of living factors. The adjustment applies only to that portion of installed costs pertaining to salaries. It does not apply to loading factors such as exempt material, construction machinery, motor vehicles, leases and rentals of special tools and work equipment, welfare, pension, unemployment insurance, workers compensation insurance, liability insurance, general contractor overheads, subcontractor overheads, and taxable and non-taxable fringe benefits.

The portions of various kinds of network investment affected by the adjustment are determined as follows. For heavy construction of outside plant cable, the model assumes a fully loaded direct labor cost of \$55.00 per hour for a placing or splicing technician who receives pay of \$20 per hour. For copper feeder and copper distribution cable, the HAI Model assumes that this fully loaded direct labor component accounts for 45% of the investment.

Because \$20 is 36.4% of the fully loaded \$55 per hour figure, the effect of the Regional Labor Adjustment Factor is $0.364 \times .45$, or 16.4% of the installed cost of copper cable. Therefore, the labor adjustment factor is applied to 16.4% of the installed cost of copper cable.

The labor adjustment factor also applies to pole labor, NID installation, conduit and buried placement, and drop installation. In the feeder plant, the factor applies to manhole and pullbox installation as well as to cable and other structure components.

Contract labor is used for buried trenching, conduit trenching, and manhole/pullbox excavation. Contract labor (vs. equipment + other charges) is 25% of total contractor cost. Direct salaries are 50% of the "labor & benefits" cost. The fraction of investment that represents labor cost for these items, and is, therefore, subject to the regional labor adjustment factor, is 0.25 times 0.50, or 0.125 of the trenching and excavation costs.

Once the adjustment factors are determined in this fashion, the factor is multiplied by the corresponding unit cost to determine the amount of investment affected by the adjustment. This amount is then multiplied by the specific regional labor adjustment factor to determine the modified investment. For instance, if buried installation trenching per foot is normally \$1.77, the adjustment factor of 0.125 applied to this amount is \$0.2213. If the regional adjustment was 1.07 (e.g., California), the increased installation cost is 0.07 times \$0.2213, or \$0.015.

Application of Regional Labor Adjustment Factor on Buried Installation			
Density Zone	Buried Installation per Foot	Labor Content Affected	Investment Affected per Foot
0-5	\$1.77	0.125	\$0.2213
5-100	\$1.77	0.125	\$0.2213
100-200	\$1.77	0.125	\$0.2213
200-650	\$1.93	0.125	\$0.2413
650-850	\$2.17	0.125	\$0.2713
850-2,550	\$3.54	0.125	\$0.4425
2,550-5,000	\$4.27	0.125	\$0.5338
5,000-10,000	\$13.00	0.125	\$1.6250
10,000+	\$45.00	0.125	\$5.6250

Application of Regional Labor Adjustment Factor on Conduit Installation			
Density Zone	Conduit Installation per Foot	Labor Content Affected	Investment Affected per Foot
0-5	\$10.29	0.125	\$1.2863
5-100	\$10.29	0.125	\$1.2863
100-200	\$10.29	0.125	\$1.2863
200-650	\$11.35	0.125	\$1.4188
650-850	\$11.38	0.125	\$1.4225
850-2,550	\$16.40	0.125	\$2.0500
2,550-5,000	\$21.60	0.125	\$2.7000
5,000-10,000	\$50.10	0.125	\$6.2625
10,000+	\$75.00	0.125	\$9.3750

Application of Regional Labor Adjustment Factor on Manhole Installation			
Density Zone	Manhole Excavation & Backfill	Labor Content Affected	Investment Affected per Manhole
0-5	\$2,800	0.125	\$350
5-100	\$2,800	0.125	\$350
100-200	\$2,800	0.125	\$350
200-650	\$2,800	0.125	\$350
650-850	\$3,200	0.125	\$400
850-2,550	\$3,500	0.125	\$438
2,550-5,000	\$3,500	0.125	\$438
5,000- 10,000	\$5,000	0.125	\$625
10,000+	\$5,000	0.125	\$625

Application of Regional Labor Adjustment Factor on Fiber Pullbox Installation			
Density Zone	Pullbox Excavation & Backfill	Labor Content Affected	Investment Affected per Pullbox
0-5	\$220	0.125	\$27.50
5-100	\$220	0.125	\$27.50
100-200	\$220	0.125	\$27.50
200-650	\$220	0.125	\$27.50
650-850	\$220	0.125	\$27.50
850-2,550	\$220	0.125	\$27.50
2,550-5,000	\$220	0.125	\$27.50
5,000- 10,000	\$220	0.125	\$27.50
10,000+	\$220	0.125	\$27.50

Application of Regional Labor Adjustment Factor on Copper Distribution Cable Installation			
Copper Distribution Cable Size	Installed Copper Distribution Cost	Labor Content Affected	Investment Affected per Foot
2400	\$20.00	0.164	\$3.28
1800	\$16.00	0.164	\$2.62
1200	\$12.00	0.164	\$1.97
900	\$10.00	0.164	\$1.64
600	\$7.75	0.164	\$1.27
400	\$6.00	0.164	\$0.98
200	\$4.25	0.164	\$0.70
100	\$2.50	0.164	\$0.41
50	\$1.63	0.164	\$0.27
25	\$1.19	0.164	\$0.20
12	\$0.76	0.164	\$0.12
6	\$0.63	0.164	\$0.10

Application of Regional Labor Adjustment Factor on Copper Riser Cable Installation			
Copper Distribution Cable Size	Installed Copper Distribution Cost	Labor Content Affected	Investment Affected per Foot
2400	\$25.00	0.164	\$4.10
1800	\$20.00	0.164	\$3.28
1200	\$15.00	0.164	\$2.46
900	\$12.50	0.164	\$2.05
600	\$10.00	0.164	\$1.64
400	\$7.50	0.164	\$1.23
200	\$5.30	0.164	\$0.87
100	\$3.15	0.164	\$0.52
50	\$2.05	0.164	\$0.34
25	\$1.50	0.164	\$0.25
12	\$0.95	0.164	\$0.16
6	\$0.80	0.164	\$0.13

Application of Regional Labor Adjustment Factor on Copper Feeder Cable Installation			
Copper Feeder Cable Size	Installed Copper Feeder Cost	Labor Content Affected	Investment Affected per Foot
4,200	\$29.00	0.164	\$4.76
3,600	\$26.00	0.164	\$4.26
3,000	\$23.00	0.164	\$3.77
2,400	\$20.00	0.164	\$3.28
1,800	\$16.00	0.164	\$2.62
1,200	\$12.00	0.164	\$1.97
900	\$10.00	0.164	\$1.64
600	\$7.75	0.164	\$1.27
400	\$6.00	0.164	\$0.98
200	\$4.25	0.164	\$0.70
100	\$2.50	0.164	\$0.41

Application of Regional Labor Adjustment Factor on Fiber Feeder Cable Installation				
Fiber Feeder Cable Size	Installed Fiber Feeder Cost	Labor Content Affected	Factor	Investment Affected per Foot
216	\$13.10	\$2.00	0.364	\$0.73
144	\$9.50	\$2.00	0.364	\$0.73
96	\$7.10	\$2.00	0.364	\$0.73
72	\$5.90	\$2.00	0.364	\$0.73
60	\$5.30	\$2.00	0.364	\$0.73
48	\$4.70	\$2.00	0.364	\$0.73
36	\$4.10	\$2.00	0.364	\$0.73
24	\$3.50	\$2.00	0.364	\$0.73
18	\$3.20	\$2.00	0.364	\$0.73
12	\$2.90	\$2.00	0.364	\$0.73